ACTIVE SEAL ASSEMBLIES FOR MOVABLE WINDOWS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application relates to and claims priority to U.S. Provisional Application No. 60/552,781 entitled "Active Seal Assemblies" and filed on Mar. 12, 2004, the disclosure of which is incorporated by reference herein in their entirety.

BACKGROUND

[0002] This disclosure generally relates to seals and more particularly, to active seal assemblies that interface with a slidable closure member such as a movable automotive window.

[0003] Current methods and assemblies for sealing opposing surfaces such as movable windows, for example, include the use of flexible elastic membranes and structures that sealingly compress against an abutting surface. Typical materials include various forms of elastomers, e.g., foams and solids, that are formed into structures having solid and/or hollow cross sectional structures. The geometries of the cross sections are varied and may range from circular forms to irregular forms having multiple slots and extending vanes. Current seals utilized for sealing opposing surfaces such as the movable window noted above are generally passive. That is, other than innate changes in modulus of the seal material due to environmental stimuli, the stiffness and cross sectional geometries of the seal assemblies cannot be changed or controlled remotely. Because of this, the seal force applied against the window during movement is generally the same when the window is stationary. Consequently, to effect movement of the window, drag forces must be overcome and compensated for in terms of motor design for the movable window.

[0004] Another problem with current seals is the tradeoff in seal effectiveness. Increasing the interface pressure and/or area of the seal can generally increase seal effectiveness. In automotive applications, such as the movable window, the increased interface pressure and/or area of the seal can affect the magnitude of forces required to effect opening and closure of the window.

[0005] Accordingly, it is desirable to have active seal assemblies for movable windows that can be controlled and remotely changed to alter the seal effectiveness, wherein the active seal assemblies actively change modulus properties. In this manner, window opening and closing efforts can be minimized yet seal effectiveness can be maximized when the window is stationary.

BRIEF SUMMARY

[0006] Disclosed herein are active seal assemblies and methods of use for automotive window systems. In one embodiment, the window system comprises a movable window slidably disposed within a stationary frame; a seal assembly in sealing communication with the movable window, the seal assembly comprising a active material operative to change at least one attribute in response to an activation signal, wherein a seal force of the seal assembly against the window changes with a change in at least one attribute of the active material; an activation device in operative communication with the active material; and a controller in operative communication with the activation device.

[0007] In another embodiment, a vehicle window system comprises a movable window slidably disposed within a stationary frame; a seal assembly in sealing communication with the movable window, the seal assembly comprising a seal structure, and a active fluid disposed within the seal structure, wherein the active fluid is operative to change at least one attribute in response to an activation signal, wherein a seal force of the seal assembly against the window changes with the change in the at least one attribute of the active material; an activation device in operative communication with the active fluid; and a controller in operative communication with the activation device.

[0008] A process for operating a vehicle window system comprises disposing a seal assembly in sealing communication with a movable window, wherein the seal assembly comprises a active material operative to change at least one attribute in response to an activation signal, wherein a seal force of the seal assembly against the window changes with the change in the at least one attribute of the active material; simultaneously moving the window and reducing the seal force by activating the active material; and increasing the seal force when the window is stationary by discontinuing the activation signal to the active material.

[0009] The above described and other features are exemplified by the following figures and detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Referring now to the figures, which are exemplary embodiments and wherein like elements are numbered alike:

[0011] **FIG. 1** illustrates an exploded view of an exemplary vehicle door and window suitable for use with an active seal assembly in accordance with the present disclosure;

[0012] **FIG. 2** illustrates a sectional top down view of an active seal assembly in sealing communication with the window taken along lines **2-2** of **FIG. 1**;

[0013] **FIG. 3** illustrates a cross sectional view of the active seal assembly of **FIG. 2**;

[0014] **FIG. 4** illustrates a partial cross sectional view of an active seal assembly disposed within the vehicle door of **FIG. 1** in accordance with another embodiment;

[0015] **FIG. 5** illustrates a cross sectional view of an active seal assembly in accordance with another embodiment;

[0016] **FIG. 6** illustrates a cross sectional view of an active seal assembly in accordance with another embodiment;

[0017] **FIGS. 7-8** illustrate expanded and contracted sectional views of an active seal assembly in accordance with another embodiment;

[0018] **FIGS. 9-10** illustrate expanded and contracted cross sectional views of an active seal assembly in accordance with another embodiment; and